THE MODEL ENGINEER

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The MODEL ENGINEER

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SMOKE RINGS

Our Cover Picture

● ON THIS week's cover we show a photograph of two 5-in. gauge " Hielan' Lassies " in course of construction at the works of Messrs. Gordon Green Ltd. Perhaps the most striking feature of these two models is the beautiful machining of the wheel castings, which should be an inspiration to others who are building this locomotive. The wheel-centres and tyres have been correctly reproduced and the boss of each wheel has been left proud with the spokes coming out to meet it, not to mention the countersinks in the axle-ends; all these points are, unfortunately, often absent in model locomotives seen at exhibitions. The full valve-gears, of course, have yet to be fitted, but the valve-spindle for the inside cylinder can just be seen between the frames of the right-hand chassis.

" The Model Engineer " Exhibition, 1949

● ALL READERS should make a careful note that this year's " M.E." Exhibition will be held at the New Royal Horticultural Hall, Greycoat Street, Vincent Square, London, S.W.1, from August 17th until the 27th next, both dates inclusive. The exhibition will be open, as customary, each day except Sunday, and there will be the usual attractions. Many readers will be glad to have this early announcement, as they may wish to arrange their Summer holidays to coincide with the show.

Other announcements will be published from time to time, during the next six months, in these columns, so readers are asked to watch for them.

Models and the Municipal Authorities

● WE ARE sorry to learn that the Wallington U.D. Council has turned down the application of the Croydon S.M.E. for official permission to run model power boats in the pond at Beddington Park, though it has been used unofficially for this purpose for several years. Similar refusals of privileges asked for by model engineering societies all over the country have, unfortunately, been all too common of late; yet model engineers have often been approached by public authorities and asked to assist at fetes or other functions by running model locomotives or other models, and these requests have seldom been refused.

Model engineering deserves more sympathetic consideration by municipal powers than it generally receives. Regarded simply as a recreational pursuit, or an amusement, it is well worth supporting; but even more by reason of its educational value, and the part which it plays in the development of craftsmanship, a factor of paramount interest in the industrial world of today. In view of the large sums of public money spent on facilities for sport, recreation and education nowadays, one would think that it would not be too much for model engineers to ask for a small and quite reasonable privilege which would involve no inroads on public funds at all.

S.M.E.E. Treasurer

● MR. A. J. R. LAMB has just retired from the post of Hon. Treasurer to the Society of Model and Experimental Engineers, after holding it continuously since 1916. All those who have come into contact officially with Mr. Lamb, during that long term of office, would be the first to testify to the immense amount of time and the scrupulous care which he has always put into his duties; but, to the outsider, the present healthy state of the society's financial accounts tells its own story. We join in the general good wishes which all S.M.E.E. members extend to Mr. Lamb; his retirement is accepted with regret, but he can be assured that his fellow-members fully appreciate that he leaves the job well done. We wish him many years of more freedom to spend in his workshop.

Calling Barnsley

● MR. A. CHEAL, 11, Westville Road, Barnsley, Yorkshire, writes to say that he would very much like to form a society of model engineers for Barnsley and district, if other people in that area are interested. He is a reader of THE MODEL ENGINEER, and is kind enough to say that he finds it very interesting and instructive. He has not been able, up to now, to do much model engineering, but has recently acquired a 3½-in. Drummond round-bed lathe and is now hoping really "to get down to things." Any readers who may be interested in his scheme for the formation of a local society should get into touch with Mr. Cheal at the address given above.

Why is it?

● LOCOMOTIVE ENTHUSIASTS have much cause for satisfaction when an old locomotive is destined for permanent preservation; but it is curious to notice that, when the attempt is made to restore the veteran to its original condition, some error usually creeps into the restoration.

The latest example of a "restored" engine is the *ex*-L.S.W.R. Adams 4-4-0 No. 563, which was one of the centre-pieces of the Centenary of Waterloo Station celebrations last June. At that time, it was generally acclaimed to be the most perfect example of locomotive restoration so far seen; there was nothing to criticise. True, the engine is painted in the style adopted by Dugald Drummond; but that was correct, because the engine was to be restored to the condition in which she was running in 1904, not 1895.

Just lately, we were browsing over a photograph of No. 563 taken in 1905 and, simply as a matter of interest, comparing it with a photograph taken during the centenary celebrations. The restoration has certainly been most carefully and accurately carried out. But, believe it or not, there *is* one mistake, and we wonder why. *The two whistles are mounted the wrong way about!*

Calling Liverpool

● MR. H. D. PINNINGTON, 28, Mayfair Avenue, Liverpool, 23, informs us that one or two of his friends are hoping to organise a model-makers' club in the Waterloo and Crosby district of Liverpool. He has arranged for announcements to this effect to be exhibited in appropriate shops in the district; but there may be some "M.E." readers in that area who are not yet aware of the proposal and might be prepared to support it. If so, they are invited to communicate with Mr. Pinnington at the above address, or with Mr. C. R. Williams, 18, Ennismore Road, Liverpool, 23.

Locomotive Names

● IT IS good to learn that British Railways L.M. Region are reviving some of the names which, in the past, had become really historical by reason of their association with almost the earliest years of locomotive naming. Engines of the 4-6-0 "Patriot" class, as they pass through Crewe works for rebuilding, are being selected for this distinction, and eight of the chosen names are: *Planet*, *Vulcan*, *Goliath*, *Courier*, *Velocipede*, *Champion*, *Dragon* and *Harlequin*. All of these were carried by engines on the old London and North Western Railway, while some of them originated in the 1840's on the Liverpool and Manchester Railway. Such names as these serve, not only to give each locomotive some individuality of its own, but to remind us of the great developments which have taken place during the last 100 years or more. It is much to be hoped that the Railway Executive will see fit to extend the practice of naming locomotives.

A Society for Grantham

● MR. S. L. REDSHAW has written to tell us of efforts which are being made to form a model engineering society in Grantham. There should be plenty of scope for a society in such a town, in view of the famous factories there. Aveling & Barford, Ruston & Hornsby and, of course, the *ex*-G.N.R. locomotive works all are associated with Grantham. In the model engineering field, the name of Mr. L. G. Tucker is well known to our readers. Mr. Roy Chantry and Mr. J. P. Chatburn, both expert model makers have recently been included among local residents featured in *The Grantham Journal* as indulging in "unusual hobbies" [*sic*]. We have little doubt that, when the proposed society comes into existence, the members will see to it that the local newspaper reporter's education will undergo necessary amendment! Interested readers should get into touch with Mr. Redshaw at 47, Rookery Drive, Alma Park, Grantham, Lincs.

Major W. L. Sparkes

● WE MUCH regret to learn of the death, on January 2nd, of Major Warren L. Sparkes of the Devonshire Regiment and Exeter. He was an outstanding personality, better known to model railway enthusiasts than to model engineers; but we have enjoyed his acquaintance and dynamic energy for many years. He possessed an excellent workshop at his home, and he knew how to use it and to get the very best out of its equipment. He was a staunch advocate for helping the beginner and for improving general standards of workmanship, especially in small-scale work, and, to this end, he frequently offered prizes at the "M.E." Exhibition. His cheery presence will be missed by his many friends.

MODELS and FICTION

by Donald Stevenson

MR. NEVIL SHUTE NORWAY, B.A., F.R.Ae.S., was one of the founders of Airspeed Ltd., the firm that made about 8,000 Airspeed Oxford bomber trainers during the late war, on which nearly all our bomber pilots were trained, and some of which were used on operational work. It was also responsible for the production of the Horsa gliders which were used in such large quantities at D-day.

He was educated at Shrewsbury School, R.M.A. Woolwich and Balliol College, Oxford. He served in the 1914 war in the Suffolk Regiment, and in 1922 joined the De Havilland Aircraft Company. Later he was with the Airships Guarantee Co. Ltd., as Chief Calculator, and made the flight to America and back in the R.100.

Mr. Norway, photographed on his yacht

Mr. Norway is known all over the world as Nevil Shute, the author of so many famous books, but it is not generally known that, in addition to his many other activities, he is a very keen model engineer. On receiving an invitation to go to see a model Mr. Norway had completed, I gladly availed myself of the privilege, and the following particulars of the visit will, I hope, be of interest to readers of THE MODEL ENGINEER.

When I arrived, Mr. Norway was adjusting the wireless set on his 40-ft. Hillyard schooner, which was moored alongside the

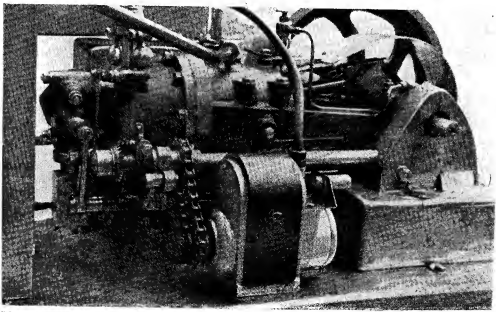


Photo by] [Mrs. N. S. Norway

A close-up of the model petrol engine constructed by Mr. Nevil Shute Norway

private jetty from the grounds of his house, on the shores of a lovely inlet off one of the harbours on the south coast.

As a yachtsman I was naturally interested in the schooner, which was specially built for Mr. Norway, so we spent some time looking over that before going to his workshop, and I was told by Mr. Norway that he had made repeated trips abroad in her.

keeps time-sheets of all the work done, as he has many interruptions and the work of a model often has to be spread over a considerable period. This is an idea which could well be copied by other model engineers, and would show some interesting and surprising results.

The model I went to see was started in September, 1944, and was not finished until February 1948, but Mr. Norway visited Burma and

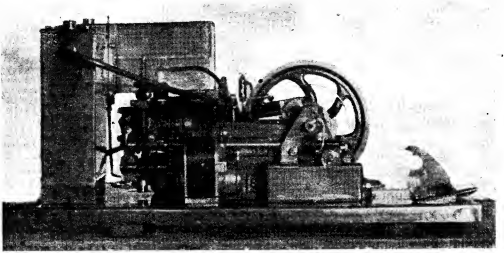


Photo by] [*Mrs. N. S. Norway*

Mr. N. S. Norway's model, with cover removed to show oil-pump

We then went across the lawns that run right down to the water's edge, to his workshop, which is a converted boathouse. It is a large, picturesque, brick building, rough-cast and painted white, with a fine deep thatched roof. It stands some distance back from the waterfront with a slipway running to it.

The front part of this building was large enough to house the cruiser, and is now reserved for what Mr. Norway calls "dirty" work. It contains a forge, an electric-driven grinder, a long woodworking bench with vice, and other similar appliances. He is now arranging to have a small electric-driven circular saw installed there as well.

Behind this there are several rooms, the largest of which is the metal shop. There he has an electric-driven lathe and drill, a hand shaper, assembly bench and metal working bench with vice and other gadgets. All the wheels, cutters and other tools for the lathe, the drills, and the hand tools are neatly stored away in flat cupboards on the walls. The electric motor drives some shafting which, in turn, drives the lathe and drill, and has some extra pulleys for driving models or anything else required. The whole workshop is very neat and orderly, with a place for everything and everything in its place.

I was particularly interested to see some time-sheets clipped together and hanging on the wall. Upon enquiry I found that Mr. Norway carefully

America in the meantime. The time-sheets showed that the total number of hours spent on the model was 550, including alterations and making the copper-covered stand on which it has been erected.

It is a horizontal petrol engine, $\frac{1}{8}$ h.p., made from Stuart Turner No. 800 castings, but with considerable modifications. For example, instead of having oilers he has added an oil-pump as shown in the photograph, for which the cover was removed. All the oil-pipes are copper, as also are the tanks. The carburettor is a special one, and he made this from a description given in THE MODEL ENGINEER.

It is an exceptionally handsome model and shows some very fine workmanship. It started up easily from cold, without any trouble, and ran beautifully.

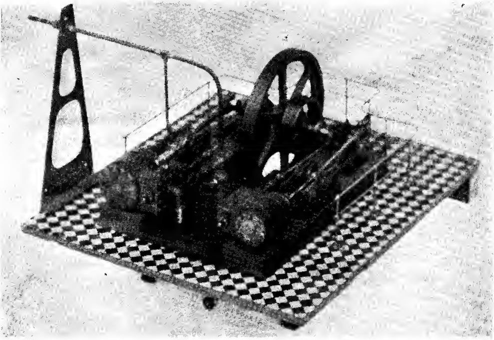
Mr. Norway, who is a very keen member and supporter of the local model engineering societies and clubs, is now planning his next model. This time, as he has such a suitable and sheltered stretch of water available, conveniently joining his place, he is thinking of making a wireless-controlled petrol-driven motor boat. He says it seems a pity not to make use of such a lovely stretch of water when it reaches almost to his workshop.

Incidentally, it is interesting to note that none of his tools show any signs of rust, in spite of

(*Continued on page* 97)

A Model Compound Condensing Mill Engine

by A. J. Pengelly



A three-quarter view of engine, showing cylinder and transfer pipe

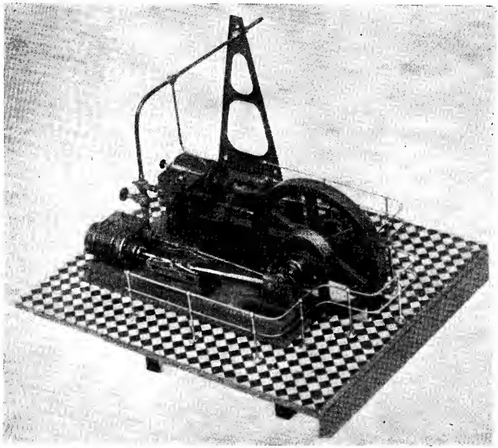
BEFORE going into details of the above engine, it will not be out of place to study the question of what really constitutes a "Mill" engine. Articles are written and photographs shown of engines described as mill engines and both the articles and pictures are such that they give no inkling to the layman as to what a mill engine really is, the commercial variety being the worst of the lot. How often do we see a model labelled as such which does not bear the slightest resemblance to a mill engine. We see a short, stubby-looking affair with very short connecting-rods, and flywheel so small that it looks as if it had been taken from a high-speed internal combustion engine.

I will, therefore, endeavour to give a picture of a real mill engine, and by that I mean the type which has been used for over a century in the great cotton mills of Lancashire and the woollen mills of Yorkshire. These are huge and majestic affairs and represent a style and quality of British craftsmanship, which, alas, is fast dying out—in fact, is almost dead. Picture to yourself then, the spotlessly clean and tiled engine room and the monster which it houses, jealously guarded by the engineer; a huge bedplate with the high and low pressure cylinders wide apart, and a large flywheel and rope drum in between the overhanging cranks. The great slipper or parallel bar guides and the long and polished connecting-rods sweep to and fro with scarcely a sound; we see the steady swing of the governors and hear the soughing sound of a dozen ropes conveying the mighty power of the engine to the roaring looms above. Beneath the engine-room floor is the big surface condenser, where are housed the "Edwards" air-pump and the circulating pumps. These are out of sight but are all performing their allotted tasks. It is a wonderful sight to see these beautiful engines at work with the great flywheel, weighing anything from 10 to 15 tons, and often 15 to 18 ft. in diameter, with face of 12 to 15 in., and running true and at a steady rate of about 75 revs. a minute.

For many years, my work as a surveying

engineer in the north gave me unique opportunities of observing and taking notes of these specimens of English and Scottish engineering wonders. I was fortunate in this respect, as strangers are rarely allowed such a privilege except by special permission, and the engineer in charge never looks with favour on intruders to his sanctum. Although away from the mill he is one of the best fellows in the world, you will find him a very grim and silent man when on duty, and a jealous guardian indeed.

4 in.; length, 5 in. with six $\frac{3}{16}$ in. and 75 5/32-in. tubes. The "Edwards" air-pump has a stroke of $1\frac{1}{2}$ in. and diameter of bore $1\frac{1}{4}$ in. and the circulating pump is three-throw, stroke 1 in., bore $\frac{1}{2}$ in., belt-driven with a reduction of 3 to 1 by means of gear wheels. The air-pump, as in the real engine, is operated by a cranked lever from the high-speed gudgeon-pin over a rocking shaft beneath the engine. The engine itself is finished, with the exception of the governors, and I have not decided yet whether these shall be



A three-quarter front view of the model compound mill engine, H.P. side

Perhaps the Editor will on a future occasion allow me to describe many of these engines, both beam and horizontal, but now I had better start describing the engine which I am building.

I decided about three years ago that I would make a model of one particular power unit which I often inspected and tested, and is still working not a hundred miles from Blackburn. The dimensions are as follows: bore and stroke: 1 in. × $1\frac{1}{2}$ in. × $1\frac{1}{2}$ in.; flywheel: $7\frac{1}{2}$ in. diameter × $\frac{7}{8}$ in. face; width of engine over cylinder, 9 in.; length of bedplate approximately 15 in.; surface condenser, diameter

belt or gear driven. I am not quite satisfied with the crankshaft and I expect that when I feel inclined, I shall make another and also a larger rope drum.

I have kept the various parts as near as possible, to scale, but found that Nature had a finger in the pie, which made this rule difficult to follow. For instance, bearing in mind the fact that this is to be a *working* model, I found it necessary to make the guard rails of a thickness which strictly to scale represent a handrail of $1\frac{1}{2}$ in. diameter when in reality it should not exceed 1 in. The *A* bracket, shown in the photograph had to be put in to

support the steam pipe ; this of course, in the real thing would be the wall of the engine room. I was lucky with the flywheel, however. Having tried time after time, without success to obtain a casting, I read in THE MODEL ENGINEER some time ago, Mr. K. N. Harris's description of how he altered a Stuart Turner vertical engine, and discarded the flywheel. Now this wheel just "filled the bill," so I got busy with the pen and K.N.H. obliged, but I had a rare time with lathe and file before I got that wheel into shape, as I found that originally it had been machined very much out of centre with the "Boss" but with a little extra trouble and lining up, I eventually got it balanced. All is now well and I am fully satisfied with the deal.

I would like to digress here for a moment and suggest that if it could be arranged, it would be an excellent idea to have a column in THE MODEL ENGINEER in which readers could state their wants, as I am quite sure many of us have a few odd things lying around which are of no present use to us but would probably prove a veritable blessing to someone else. So, thank you, Mr. Harris.

Well, to resume, I am mounting the engine on a long baseboard so that a section of shafting can be driven and a return belt drive for the circulating pump added. I am doing my best to get it finished, and have a proper Lancashire boiler attached in time for the 1949 show. I have had the model under steam and it works perfectly as a compound, provided the simpling valve is opened a shade for a few minutes when starting up. Like most model makers, I found plenty of snags when I started on the job. One was sparing the time, and when I did get going some unfortunate neighbour would bag me to mend a saucepan or some other domestic utensil which could not be replaced at that time, until I really thought that I should have been a tinker instead of a staid old engineer, and I really believe that I must have repaired at least half the pots and pans in this town, not to mention lighters and flash lamps. Another and far more serious trouble was the lack of a lathe. And when, after much difficulty, I did get castings, the still greater trouble was getting them machined. I really thought once of giving up the whole thing but luck came my way and I secured a 5-in. Atlas lathe when a Midland engineering firm went "broke." Since then it has been plain sailing.

I made all my patterns and at first intended to have the bedplate cast in one piece but the machining of such a large casting was out of the question, so I decided on two separate castings mounted on a separate bedplate. For this purpose I got hold of a piece of steel plate 15 in. $\times$ 9 in. $\times$ $\frac{5}{16}$ in. and with hacksaw, chisel and 15 in. rough files I carved that horrible mass into a bedplate, and even when I was at sea forty-five years ago on old tramps I never can remember such a tough bit of filing and sawing. But what a joy to finally get on top of such a job. All tears and sweat are forgotten in the achievement.

Considerable care was necessary in aligning the two beds with the crankshaft, and once this was done, the whole lot was really made good and tight so that under working conditions there would be no danger of movement of the two units.

Both the flywheel and eccentric are keyed on to the shaft, as I do not like to see ugly set-screws for this purpose. It is really quite easy to secure eccentric sheaves with small "saddle" keys, and this looks more realistic on a model. I know, of course, that on model locomotives, there is not space enough for this, so that set-screws must, of necessity, be used, but even then they can be hidden.

As regards the governors, I wanted to drive them direct but I have not been able to find any firm who can supply helical gears. I cannot understand this, as I know that there is a demand for such gears. A good deal of the work is out of sight under the bed, such things as the drain cocks are carried on extension pipes and operated from underneath.

MODELS and FICTION

(*Continued from page* 94)

their close proximity to the sea and being in the sea air. The fact that his workshop is so substantially built, and properly lighted, ventilated and warmed, no doubt accounts for this.

After spending a considerable time in the workshop we walked through the prettily wooded grounds, visiting his bees, poultry, pigs (the latter housed in a most luxurious sty made out of an elaborate air raid shelter) and the part of the grounds he is digging up for vegetables, until we came to his study.

This is a separate building, near to but not joined on to the house, and has been the birthplace of so many of his well-known books such as *Marazan, So Disdained, Lonely Road, Ruined City, Happened to the Corbetts, An Old Captivity, Landfall, Pied Piper, Pastoral, Most Secret, Vinland the Good* (a film play), *The Chequer Board,* and *No Highway*.

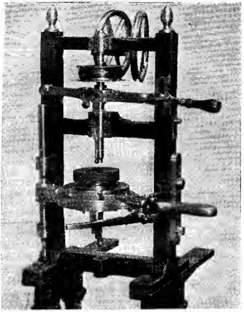
As we sat there talking Mr. Norway made some very interesting remarks about model making in America. He said that, during a recent visit there, it did not appear to him that they have as much enthusiasm for models in that country as we have over here. A big percentage of what modellers there are, seem to be more interested in woodwork, than in engineering models, with, perhaps, the exception of model racing cars and model aero engines. He stated that one seldom sees, in America, any of those interesting tool shops that we are so fond of, and spend so much money in. He does not think that they take model making as seriously as we do, and he could not find any equivalent in that country to our periodical THE MODEL ENGINEER.

The photographs are by Mrs. N. S. Norway, who very kindly took them specially for this article.

chunks of wood to the finished product. These machines, several of which were demonstrated in the Exhibition display, were built by Henry Maudslay, and are of great interest both in their design and construction.

The blocks were first bored on a special boring machine with two holes at right-angles, accurately located and of fixed depth, adjustable stops being provided to ensure uniformity. A mortising machine then chiselled a slot in the block, connecting with one of the holes ; it is worthy of note that this machine was fitted with a cone friction clutch, one of the first practical applications of such a device.

The external shape of the block was produced on a most remarkable shaping machine, embodying means of dealing with ten blocks simultaneously, each block being held between a point centre and a driving centre, and operated on by a gouge, the path of which was controlled by a template. A similar operation was carried out on the opposite side of the block, but for the other two sides, a different template was used. Indexing of all the blocks about their centres was simultaneously and automatically carried out as the main drum revolved. In this machine we have the elements of the turret lathe, the contour copying lathe, and the multi-spindle automatic lathe.



The " coaking machine " used for profile milling recesses in pulleys, equipped with indexing and unloading gear, cutter depth adjustment, and a collet chuck

Grooving was carried out on a " scoring machine," in which the blocks were mounted in pairs on a pivoted platform which was manipulated by hand to traverse the blocks across rotating form-cutters carried on an upper shaft. The pulley sheaves were machined simultaneously on the centre and periphery by a " rounding machine " which incorporated a drill and a trepanning cutter on a rotating shaft. A shallow recess was profile-milled in the side of the sheave by means of a " coaking machine," to receive a brass insert known as a " coak," which formed the bearing of the pulley on the spindle passing through the centre of the block.

The adoption of this system of production, which cost the Admiralty £54,000 to install, speeded up production ten times and resulted in a saving of £17,000 annually.

Although some of the more spectacular phases of machine tool development, and its application to rapid quantity production, in the present century, may be claimed by other countries, the evidence which this display provides will clearly show that all the essentials of standardised design, operational sequence, accuracy, speed of production and reduced cost were put into effect by British engineers, a whole century earlier. Space does not permit of dealing at greater length with the early history of machine tools, and the men who produced them, but the story is recorded in greater detail in the October-December issue of the *British Machine Tool Engineering Journal*, including further illustrations of early machine tools and also details of the hand tools used by engineers of this period.

Model Beam Engines at Bradford

THE new " beam engines " exhibit at the Cartwright Memorial Hall Museum, Bradford, is to be on view until June 30th, and has been planned to illustrate briefly how this type of engine was developed from 18th century pumping engines, and also to augment another exhibit containing Mr. W. D. Hollings's working model beam engine, which has been on view for the past year and is one of the museum's popular exhibits.

The centre-piece is a model of a Cornish pumping engine, built by Mr. Frank D. Woodall, of Shipley, who for many years has made a special study of mining machinery. The remainder of the exhibit comprises four model beam engines lent by Mr. J. Mortimer, of Ilkley, Mr. L. Mortimer, of Calverley, Mr. Bernard Sutcliffe, of Bradford, and Mr. A. E. Smith, of Pudsey.

IN THE WORKSHOP

by "Duplex"

*29—Cross-Drilling

THE simple type of cross-drilling jig illustrated in Fig. 1 is easily made and will be found a useful piece of equipment for drilling shafts of from $\frac{1}{4}$ in. to 1 in. in diameter. Moreover, as shown in Fig. 2, a work- or distance-stop can readily be fitted for the quick and accurate end-location of parts when repetition work is undertaken.

As will be seen in the drawings, the cast-iron base block has a right-angled V-shaped groove machined in its upper surface, and an additional shallow groove is provided for catching the drilling swarf. The saddle-piece not only carries the bushes or collets to guide the drill, but it also serves as a clamp for securing the work in position. This mode of construction ensures that the guide bush is brought as close as possible to the surface of the work, where it is in the best position to afford guidance to the point of the drill. When, therefore, the clamping-nuts are tightened, both the work and the guide collet are securely held in place by the saddle.

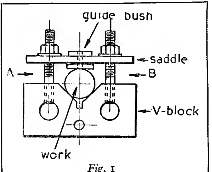


Fig. 1

The guide bushes used in this instance are standard Card dieholder collets, but, as will be described later, these can be quite easily made as required.

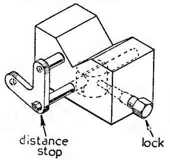


Fig. 2

It will be appreciated that to set the jig to drill radially, it is essential that the saddle plate should be adjusted to lie parallel with the upper surface of the base block. This requirement, of course, renders the jig unsuitable for use in production engineering, where quick loading of the work into the jig is of prime importance; but in the small machine shop, on the other hand, the skilled operator will hardly find this delay a serious matter when a single part or a small number of components has to be drilled. The means employed for setting the jig will be considered later when the method of using it is described in detail.

The Base Block

The dimensions of this part are shown in Fig. 3 and also in the working drawings in Fig. 4 (1), and although these measurements are those actually used, there is no necessity to adhere strictly to them, provided that the material selected is large enough to accommodate the essential fittings.

The base block may be an iron casting, or a short length of mild-steel square bar can be used, but, unless the steel base is case-hardened, the cast-iron material will have rather better wearing qualities. Although the three holes drilled across the base are intended primarily for fitting the work-stop, they are also employed for securing the part in the lathe when machining the V-groove. However, should this machining operation be carried out in the shaping machine and it is decided not to fit a work-stop, then the holes in question can be omitted.

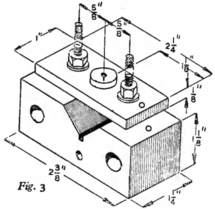


Fig. 3

The base block should be machined on all its surfaces either in the shaping machine or by a turning operation in the lathe.

*Continued from page 45, "M.E.," January 13, 1949.

In this connection, it is essential that the upper and lower surfaces should be formed parallel, and one at least of the long sides must be machined truly at right-angles with the base to enable the block to be set up accurately in the lathe when machining the V-groove in accordance with Fig. 5.

When the block has been trued by filing, shaping, or turning, and then scraping, the holes for the work-stop are marked out and drilled, with the aid of a square applied to the edge of the cross slide, or by using the test indicator attached to the pillar of the surface gauge.

In the latter case, the guide-pins in the base of the gauge are engaged with the shear of the lathe bed, so that the test indicator can be moved over the surface of the angle-plate in a direction parallel with the lathe axis.

The base block is attached to the angle-plate with two bolts passing through the holes drilled

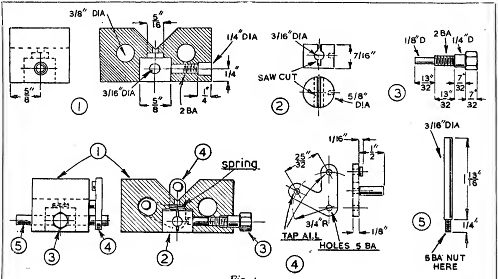


Fig. 4

but the central holes which receive the sliding spindle of the stop is reamed to its finished size at a later stage when the split clamping-piece (2) is fitted.

The next step is to mark out the 90 deg. V on the upper surface and two sides of the block, and at the same time a punch mark is made at the apex of the V to indicate the drilling centre for the $\frac{1}{8}$ in. diameter hole which is drilled from side to side of the block to form the swarf groove.

Those possessing a shaping machine will be able to machine the V-groove with the block held squarely in the machine vice, but where a small lathe is employed to form the V by a milling operation, it is advisable, as a preliminary measure, to remove the bulk of the metal with a hacksaw and to follow this with a file.

The reason for this is that the ordinary light type of lathe is not well adapted for removing metal in bulk by milling, and, moreover, it is inadvisable to risk blunting an expensive milling cutter in so doing. These milling operations in the small lathe are, therefore, best regarded as finishing processes for producing flat surfaces and bringing parts accurately to size.

As illustrated in Fig. 5, for the milling operation the work can be mounted on a small angle-plate bolted to the cross slide of the lathe. The angle-plate must be set with its upright bolting face parallel with the lathe axis; this is done either to receive the work-stop; and at the same time the under surface of the base is set to an angle of exactly 45 deg. to the surface of the cross slide by means of a mitre square or a protractor.

The milling operation for forming the V accurately to size is carried out either with a toothed side- and face-milling cutter, or by means of a fly-cutter mounted in a boring bar of the "Nulok" pattern, as shown in the drawing. The horizontal limb of the V is first machined by taking a series of cuts across its surface, and the upright face is then milled true at the same setting of the work. The depth of cut when machining the horizontal face is adjusted either by setting the cutter-bit further outwards in its holder, or by readjusting the setting of the four-jaw chuck in which the bar is held. The amount of adjustment made to the cutter can be readily measured by bringing the point of the tool into contact with the button of the test indicator while the mandrel is turned slowly by hand; if the test indicator is located in the manner already described for setting the angle-plate, it can be replaced accurately in position at any time when readjustment of the cutter is required.

The V-block is now transferred to the drilling machine, and to facilitate the fitting of the work-stop at a later stage, a $\frac{1}{8}$ in. diameter hole is drilled centrally in the floor of the V, as shown in Fig. 4 (1). Following this, the block is gripped,

base outwards, in the four-jaw chuck and the $\frac{1}{8}$-in. drill hole is set to run truly with the aid of the centre-finder or wobbler in conjunction with the test indicator. When the V-block has been correctly centred in this way, the recess is bored in the base to accommodate the small pressure spring and the split clamping-piece (2).

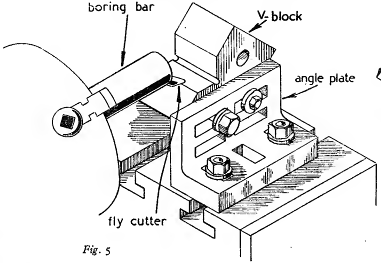


Fig. 5

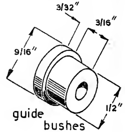


Fig. 7

Making and Fitting the Saddle Plate

The main dimensions of the saddle are given in Fig. 3, and it will be observed that one end is marked with an -O- to correspond with a similar figure on the upper surface of the V-block in order to ensure that the jig is always correctly assembled. The saddle illustrated, although of light construction, is sufficiently robust for all ordinary work, but if preferred it can be made from thicker material.

After the piece of mild-steel strip forming the saddle has been filed and scraped flat, it is marked-out in accordance with the drawings in Figs. 3 and 6. The central hole is drilled and then reamed to $\frac{1}{2}$ in. diameter to accommodate a standard collet, but as an alternative the plate can be centred in the four-jaw chuck and the hole finished to size with a small boring tool.

The holes for the passage of the two studs are in the first instance drilled with a No. 22 drill. The next operation is to fit the studs into the V-block, and on the manner in which this is carried out will depend the accurate working of the finished jig. To line up the central hole in the saddle with the V-groove, a shouldered setting-piece is turned similar to the collet shown in Fig. 7. This setting-piece must not only be a good fit in the saddle, but its projecting base portion must be of the correct length to allow it to make contact with the sides of the V-groove when the saddle just touches the upper surface of the block. When making the final adjustment, if necessary, thin metal shims of equal thickness on the two sides may be interposed between the saddle and the block.

The saddle is now firmly secured in place with two toolmaker's clamps and a No. 22 drill,

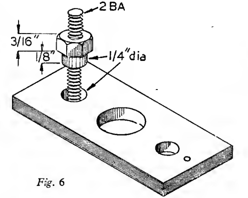


Fig. 6

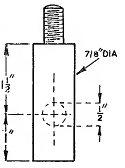


Fig. 8

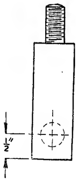


Fig. 9

guided by the drilled holes in the saddle, and is fed in to meet the large cross-holes as represented in Fig. 1. A letter D drill is then used to enlarge the holes in the saddle and also to make light countersinks in the upper surface of the block. The stud holes are tapped truly by mounting a No. 2-B.A. tap in the drill chuck and turning the machine spindle, either by rotating the driving pulley by hand or by using a handle, specially made for the purpose, attached to the upper end of the spindle.

The holes in the saddle for the passage of the studs are carefully enlarged to the finished size with a $\frac{1}{4}$-in. diameter reamer.

When machining the clamping-nuts in the lathe, they should be made a good working fit in the holes in the saddle, and at the same time they must be accurately tapped; the skirt of the nuts may be lightly chamfered to give easy engagement when loading the jig.

Guide Collets

The collets illustrated in Fig. 7 are turned from $\frac{5}{8}$-in. diameter round bar, and either silver-steel or mild-steel may be used with a view, possibly, to subsequent hardening or case-hardening; but it will generally be found that unhardened silver-steel guides have sufficient resistance to wear to warrant their use in the small machine shop.

As it is important that the collets should fit the saddle accurately, the use of a stop fitted to the lathe cross slide will greatly facilitate the turning operation and will ensure interchangeability when making a batch of these components.

The methods employed to ensure true axial drilling of the central guide holes in the collets have been described in detail in previous articles and so need not be repeated.

Fitting the Work-stop

The general arrangement of this assembly is shown in Fig. 2, and the detailed dimensions of the several parts are given in the working drawings in Fig. 4.

The clamp-piece (2) is turned to a light press fit in the base of the block, and when in place it should lie just below the surface of the base. It is then secured in this position by means of a toolmaker's clamp, using a small washer against the clamp-piece and a length of brass rod in the V-groove to take the clamping pressure. The clamp-piece must be marked so that on assembly it can be replaced in its original position.

The block is now gripped in the machine vice and a No. 13 drill is used in the drilling machine to continue the previously drilled hole right through the clamp-piece, as represented in Fig. 2; this hole is then finished to size with a $\frac{3}{16}$-in. diameter reamer. After removal of the clamp-piece by means of a brass punch inserted in the $\frac{1}{8}$-in. diameter hole that was previously drilled in the floor of the V-groove, its periphery is treated with a strip of emery cloth to make it an easy push fit in its recess.

To allow the clamp-piece to close on the spindle of the work-stop and secure it in place, a cut is made with a fine hacksaw, as illustrated in the drawing in Fig. 4 (2).

The location of the hole to receive the clamp-screw (3) is marked out in accordance with the working drawings by employing either the surface gauge or the jenny callipers, and this hole is then drilled, recessed and tapped. Making the clamp-screw itself is a straightforward turning and threading operation, and it will be seen that for the sake of appearance the screw threads are kept out of sight by forming a shoulder on the screw.

The spindle (5) of the work-stop is either turned to size or, preferably, made from a length of

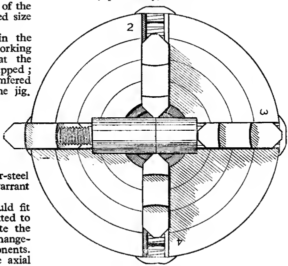


Fig. 10

silver-steel or other accurately-finished material; one end is turned down and threaded 5 B.A. to carry the quadrant and a lock-nut, as shown in Fig. 2.

The quadrant (4) is cut out from a piece of mild-steel strip and drilled and threaded in accordance with the working drawing.

The two fingers or contact-pieces, one long and one short, which acts as stops are best made of silver-steel and screwed into the quadrant. Finally, the $\frac{1}{8}$-in. diameter hole in the floor of the V-groove is closed with a plain or screwed plug to prevent swarf from entering the work-stop clamping mechanism.

Assembling the Jig

The two 2-B.A. guide studs are screwed firmly into the V-block and their vertical alignment is checked with a square; if they have been accurately made and fitted, the nuts should engage freely in the saddle at any point within its range of adjustment. A short length of coil spring is fitted in the recess in the base of the block and, when the clamp-piece has been put in place, the spindle of the work-stop is inserted, and when necessary, secured by means of the clamp-screw. It should then be found that the work-stop will slide freely under the frictional control imposed by the clamp-piece spring, and that either of the two contact-pieces can be used at will while the idle finger falls into one of the two large holes drilled in the block.

The Jig in Use

As previously mentioned, the working accuracy of the jig is dependent on the setting of the saddle exactly parallel with the upper surface of the V-block, and, in general, this can be done either with the aid of a rule or a taper gauge.

As the upper and lower surfaces of the block have been formed truly parallel, the saddle can also be adjusted by applying a pair of callipers at the two ends over the combined thickness of the block and the saddle; alternatively, the parallelism of the upper surface with the base can be determined by means of the test indicator, used in conjunction with the surface gauge and surface plate, as has been previously described.

The clamping-nuts should be tightened sufficiently to secure the work in place but without over-stressing or bending the saddle.

When a batch of components is being drilled, it may be found that the work can be withdrawn if one only of the saddle clamp-nuts is slackened; the jig can then be reloaded and the work secured solely by tightening the other clamping-nut, so that the parallel adjustment of the saddle is thus maintained throughout.

The setting of the work-stop, with a rule applied to the base of the collet, requires no explanation, save that the stop should be securely clamped when repetition work is undertaken.

When cross-drilling a sleeve or other part mounted on a shaft, the components should be fitted firmly together so that no relative movement can take place during the drilling operation.

Should a long shaft have to be cross-drilled, the outlying end should be supported at the correct height by means of a packing-piece or in a second V-block. For the actual drilling operation, the guide collet should be of the correct size to support the drill with only a small working clearance.

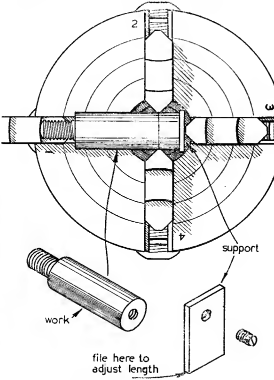


Fig. 11

Cross-drilling and Cross-boring in the Lathe

When a hole of relatively large diameter has to be cross-drilled in a short length of shafting or other such component, it will often be found more satisfactory to carry this out with the work mounted in the lathe chuck, for the preliminary drill hole can then be accurately machined to size by a final boring operation.

As an example of the methods employed, the machining of a cross-hole, $\frac{1}{2}$ in. in diameter, in two short machine spindles, $\frac{7}{8}$ in. in diameter, will be described.

In the first spindle the centre of the cross-hole lay 1 in. from the end of the shaft, and in the second shaft $\frac{1}{2}$ in. only from the end, as represented in Figs. 8 and 9.

The marking-out operation consisted in scribing a line with the jenny callipers 1 in. and $\frac{1}{2}$ in. respectively from the ends of the two shafts. The shaft shown in Fig. 8 was gripped as nearly central as possible in the four-jaw chuck, so that, as shown in Fig. 10, the shaft itself lay in the channel formed in the face of the chuck to carry No. 1 and 3 jaws; this ensured that the work was located in a plane at right-angles to the lathe axis.

The next step is to locate the centre-line of the shaft at the lathe centre height. This is done by adjusting jaws 2 and 4 until the test indicator mounted on the lathe bed shows that they are set concentrically. As both the inner and the outer gripping faces of the jaws are accurately ground, either of these surfaces may be used as a reference surface when making the adjustment, but usually the outer surface of the jaw will be found more accessible. To set the shaft in the correct position endwise so that the centre of the scribed cross-centre line lies on the lathe axis, the back centre or a pointed rod held in the tailstock chuck is brought into contact with the work face. In the case in point, it was found that the centre marked on the work in this way lay $\frac{1}{16}$ in. from the cross-centre line and towards No. 3 jaw; No. 1 jaw was, therefore, backed away and No. 3 jaw advanced $\frac{1}{16}$ in. by giving a half-turn to its $\frac{1}{8}$-in. pitch feed screw.

When this preliminary setting had been completed, all the chuck jaws were tightened and the accuracy of the mounting was again checked.

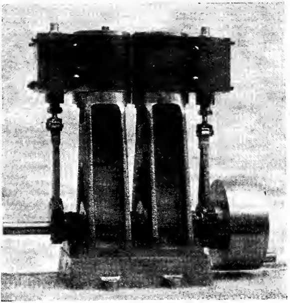
It now only remains to drill out the hole centre with a centre drill held in the tailstock chuck, and after the cross-hole has been drilled nearly

(*Continued on page* 109)

Utility Steam Engines

by Edgar T. Westbury

IT is now some years since I last wrote on the subject of steam engines, and as on that occasion, it is more than likely that some readers may be surprised, or even slightly shocked, that I should venture into this territory at all. As a result of my long association with internal combustion engines, I have acquired the reputation of being antagonistic to every other form of motive power; a totally erroneous idea, which I have found embarrassing at times, and which is extremely difficult to live down. Once, when lecturing to a model engineering society on model petrol engines, I was introduced by the Chairman as "the sworn enemy of steam engines!" But, as Mark Twain said when somebody published a premature account of his funeral, this was "slightly exaggerated." I have never published or said anything to deter model engineers from building steam engines, or to damp their enthusiasm for them; on the other hand, I have always had a keen interest in steam engines of all types, moreover I have made many experiments with them, and have designed and constructed them both in orthodox and unorthodox forms.



A $\frac{3}{4}$-in. × $\frac{3}{4}$-in. twin-cylinder engine made from castings by Messrs. Dick Simmonds, of Erith

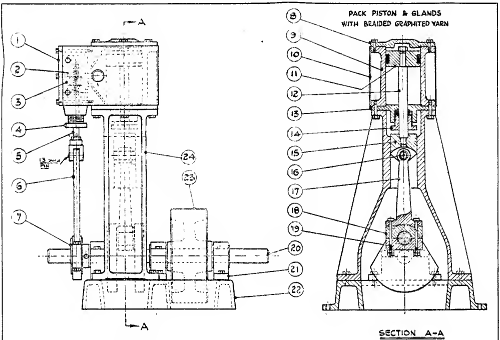
In the past, the steam engine enthusiast has been very well served by the many writers in THE MODEL ENGINEER who have furnished designs and constructional data on model steam engine design, not to mention the many dealers in model supplies who offered castings and parts for these engines in wide variety. Things seem to have changed, however, at the present time; if one excepts the steam locomotive, which is as popular as ever, there seems to be a decline in the popularity of steam engines among model constructors, and there is comparatively little material available for their construction—and still less that is novel, original and progressive. It is for this reason that I am prompted to come forward with some comments and practical information which, I trust, will prove helpful to those whose interest in the steam engine has not yet been expressed in concrete form.

In discussing this subject recently with an old and experienced model engineer, he expressed the view that the construction of a simple steam engine should be taken as a kind of qualifying test for the novice who wishes to become a member of a model engineering society. While violently opposed to the idea of any form of compulsion, or conditions of entry, in this matter, I approve in general principles of the idea that every model engineer should for his own sake build at least one good steam engine in his life. There is no form of engine which so closely knits up all the basic principles of engineering in a combined whole, not only in respect of the actual work involved, which includes fitting, turning, coppersmithing and often other workshop processes, but also underlying principles of mechanics and other fundamental physical laws. For this reason the steam engine serves as an ideal test subject for the manual skill and intelligence of the engineering student; it both deserves and repays careful study, and for this reason one is inclined to wonder why it is so often neglected or overlooked by technical schools.

Many model engineers who pride themselves on having an up-to-date outlook, regard the simple steam engine as beneath their notice, in their impatience to reach the more ambitious heights attainable by modern high-performance engines. In this way they miss not only much pleasure and interest, but also the experience both in constructing and handling engines which might have been very useful in their inevitable problems and wrestlings with engines much less docile and tractable. However, it is no use telling model engineers what they ought to do; the important thing is to prove to them that the

steam engine is not only at least as attractive as any other form of model, but it is also capable of development to just as high an efficiency as the petrol or compression-ignition engine. If one seeks versatility, or the widest scope of application to various duties, here again the steam engine has considerable merit; and the variety of forms and designs in which it may be produced is without limit. All this has been said many times in the past by other and more notable exponents of the steam engine than myself, but I take this opportunity of emphasising these points, lest they may be in danger of being forgotten.

To the student of engineering history, the various stages in the progress of steam engine design, including stationary types such as beam, grasshopper, steeple, table, and direct-acting horizontal engines, and side-lever, trunk, diagonal and direct-acting vertical engines for marine propulsion are of outstanding interest, and have received due attention from model constructors. But while recommending model engineers not to neglect the construction of such models for their own sake, the main intention of these articles is to concentrate attention on engines which are built for the definite purpose of furnishing motive power to boats or other types of models. Nowadays, many model engineers regard an engine from the aspect of what it will *do*, rather than what it *is*; an attitude of mind which is possibly engendered, in some measure, by the tendency for the large scale production of engines which will work, and in some cases produce plenty of power, but have little else to commend them from the aesthetic point of view. While I am strongly of the opinion that every model engine should be a worthy end in itself, rather than a mere means to an end, I realise that in many cases the success of a working model depends upon the efficiency or convenience of its power plant, and the accent is therefore on Utility—using the term in its literal sense, rather than in its degraded modern appellation, which only too often signifies something ugly and shoddy which only just passes muster. Even if an engine is built to a severely simple plan, to perform some modest or even sordid job, there is no reason why it should not be as pleasing in form and as excellent in workmanship as the constructor can make it; both qualities will enhance the pleasure of building it, and the satisfaction when it is completed—not to mention the service it will give in performing its allotted tasks.



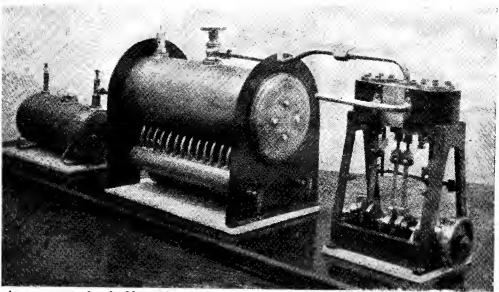
The single-cylinder version of the Dick Simmonds engine design

I propose in this series of articles to give some examples of engines ranging from the simple and orthodox to the more advanced and unorthodox, including drawings and a certain amount of constructional information such as is likely to be helpful to the inexperienced constructor. Nothing is claimed for these designs except that they work, and will give excellent service if well made. In some cases, originality of detail is claimed, though, of course, the broad principles of steam engine design are firmly established, and can hardly be improved upon within the limits of size and type with which we are concerned. It is perhaps reasonable to assume that in 90 per cent. of the cases where a utility engine

is required, its intended purpose is for driving a model boat, and all the engines to be described are suitable for this purpose, though also applicable, or adaptable with slight alteration, to other duties.

Delusive Simplicity

The steam engine is often praised for its loudly on the theme of simplicity, which, like many other things, is a good servant but a tyrannous master. It is all very well to concentrate on the utmost simplicity in the mechanical design of an engine, but if the latter is thus rendered inefficient and uneconomical so that it requires an excessive amount of steam to perform the work required of it, and thereby imposes abnormal demands on the steam generating plant, it has defeated its own object. Always bear in mind the sound maxim that all good steam engines, whether simple or complex, must be economical. Judged from this standard, many model engines in the past, including some which have been pleasing in design and have become very popular, have had serious shortcomings.



A steam power plant by Messrs. Gordon Green Ltd., of Uxbridge, incorporating twin-cylinder engine, water-tube boiler, and blowlamp

" simplicity," but this term is one which needs qualification, and it may often prove to be a snare and a delusion. It is true that the working principles of a steam engine are basically simple and easy to understand; yet a full knowledge of its theory involves just as much intelligence and erudition as that of any other branch of engineering. A steam engine can be made without a great deal of skill, and will work after some fashion despite limitation or errors both of design and workmanship; but to build it really well, and to obtain the best efficiency of which it is capable, calls for the very best we can put into it. The simpler forms of internal combustion engines have now outstripped the steam engine in respect of sheer mechanical simplicity, though their design, structure and accuracy are much more exacting than the steam engine if they are to work successfully. But the mechanical part of the steam engine is not a complete power plant in itself; it is merely the mechanical converter of energy obtained indirectly from the combustion of fuel outside itself. Both the boiler and the heating element may be regarded as more or less independent units of the power plant, and not only their individual efficiency, but also their correlation to their requirements of the engine, are important factors in the latter's success.

All this, of course, is quite self-evident, and my only reason for calling attention to it here is to remind us that it is not prudent to harp too

Limited Power

The power of a steam engine, in theory at least, is limited only by the steam pressure available, and the mechanical structure of its working parts. In the interests of efficiency and high performance (not synonymous terms, by the way) it pays to run engines at fairly high pressure if the steam generator will sustain it; but any well-made steam engine of normal design should be capable of " ticking over " at very low pressure, and the ability to do so may be taken as a good test of workmanship and accuracy of adjustment. A late acquaintance of mine, who had made many model steam engines of every conceivable type and size, used to say " Any fool can make a steam engine work if he puts enough pressure on it—but it takes an engineer to make one work on a mere whiff." To prove that he practised his own precepts, he would then apply his mouth to the steam inlet pipe of one of his own engines, and demonstrate that

he could blow it round quite easily. (I may mention, in passing, that his workshop equipment consisted of an incredibly ancient treadle lathe with a triangular bar bed and a home-made slide-rest.)

Simple Oscillating Engines

I do not propose to devote a great deal of space to this type of engine, not that it lacks interest or utility from the model engineer's point of view, but it has been described so often in the past, in various forms and methods of construction—and will probably make equally frequent reappearances in the future, in connection with plants having simplicity as the keynote. Many model engineers have constructed engines of this type with the very simplest equipment, and without the use of the lathe ; but it is not such an easy engine to build as it looks, if one demands that it should produce a reasonable efficiency within the limitations of its primitive design. In its conventional form, the oscillating engine is suitable for use only with comparatively low-pressure steam ; in fact, one of its simple virtues is that in the event of a dangerous rise of boiler pressure, the working faces of the cylinder and port seating are forced apart and serve as an emergency safety-valve, even when the normal safety-valve is stuck—as, indeed, it usually is !

Personally, although I have made several oscillating engines in the past—mostly as Christmas presents for prospective junior " M.E." recruits—I regard the principle as more usefully applicable to small pumps for utility purposes ; such pumps are not only simple, but in my experience, the most efficient and reliable for such duties as forced lubrication in small engines. Steam engines working on this principle are an eternal attraction to the manufacturer who wishes to produce a cheap toy engine, but to the model engineer who has the use of a lathe and normal equipment, I believe the construction of a fairly straightforward slide-valve engine will prove more satisfatory and more satisfying.

Many devices have been introduced to improve the efficiency of the oscillating engine, but in most cases they have made it more difficult to construct, and some of them have succeeded in achieving a greater complication than the normal slide-valve engine, with none of its inherent advantages. I have, however, seen one example of a real improvement on the oscillating engine, which retains something like its initial simplicity, but as this device is patented and I have not had permission to describe it, I cannot say more about it here.

More Skill Needed

To me, the construction of an engine which involves the bending of sheet metal and fabrication of main components by soft-soldering, so often advocated for the " beginner's engine," seems to require more skill than the machining of castings and the normal methods of fitting ; but probably there are many readers with very different views on this subject. I shall, however, proceed to describe a number of engines, either of individual design or made from components available from the model supply trade, in which I have found the constructional methods interesting and the results satisfactory.

The illustrations given herewith show two examples of utility twin-cylinder slide-valve engines built from castings by " M.E." advertisers. Both engines are of straightforward design, and are adaptable for construction in either single- or twin-cylinder form. Complete working drawings of these engines are available from the firms concerned, both well-known and regular advertisers in THE MODEL ENGINEER.

(To be continued)

In the Workshop

. *(Continued from page* 105)

to size it is enlarged to the finished diameter by means of a small boring tool.

The second spindle presented a less simple problem, for as the centre-line of the cross-hole lay at a distance of only $\frac{1}{2}$ in. from the end, the shaft could not span the recess in the chuck face to obtain support from the opposite jaw channel.

In such a case, the free end of the shaft could be supported against a collar or distance-piece lying in the chuck recess and abutting against the inner surface of the chuck backplate.

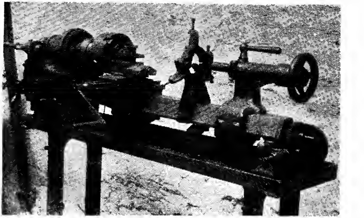
However, it so happened that the shaft in question was threaded axially to take a clamping-screw, and this enabled a distance-piece or prop to be attached to the spindle to support it in place.

As shown in Fig. 11, this distance-piece must be filed to the correct length to align the shaft horizontally when the former is located by means of a parallel screw inserted in the end of the spindle.

Care must be taken, however, to ensure that the screw does not reach as far as the outer diameter of the cross-hole, as, should it come into contact with the boring tool, it may be forced round and screwed inwards, with the result that the point of the tool will be damaged when it strikes against the projecting portion of the screw.

A 5-in. "Pittler" for a Song

by H.R.H.



I DO not know the exact value of the proverbial "song," but imagine that the purchase of a 5-in. Pittler lathe complete with stand, fixed steady and a large but very worn 3-jaw chuck, for under £10 to be well within the range of this form of currency!

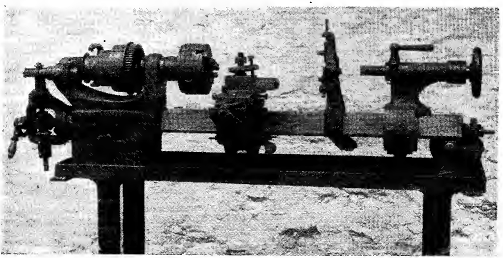
When I first discovered this Pittler it was standing all forlorn under an apple tree, with the chip-tray half full of water forming the graveyard of an assortment of flies, beetles and other insects. However, being an optimist, I refused to be dismayed by this wanton neglect, or by the broken back-gear wheel, missing worm-wheels, and one or two other deficiencies, so I paid the price asked and arranged for the collection of the lathe.

When it arrived, I quickly cleaned off all the grease and muck (and dead insects) and was suprised to find that there was little sign of rust anywhere. The two photographs reproduced here show the lathe exactly as it was after this first cleaning. Note the broken back-gear wheel, the missing top-slide handwheel, the wonderful "built-up" crank handle fitted [?] to the cross-slide feedscrew, and the amazing assortment of screws on the adjustments on the slide gibs and on the fixing of the top-slide.

At the earliest opportunity, I began stripping down the lathe and was pleased to find that there was nothing wrong that could not be put right quite easily. I was struck by the workmanship put into the machine originally—gears, handwheels, collars, in fact everything fitted to a shaft or spindle was keyed *and* set-screwed, and provision was made for taking up wear in the most unlikely places.

It was my intention to completely recondition the lathe, and still feel that it would have been very much worth while, but owing to unforeseen circumstances I was forced to sell it, though not before I had done a considerable amount of work to it—and on it. For example, when the back gear was stripped down, it was found that not only was the wheel broken, but the shaft also (someone must have had a good "jam-up").

(*Continued on page* 118)



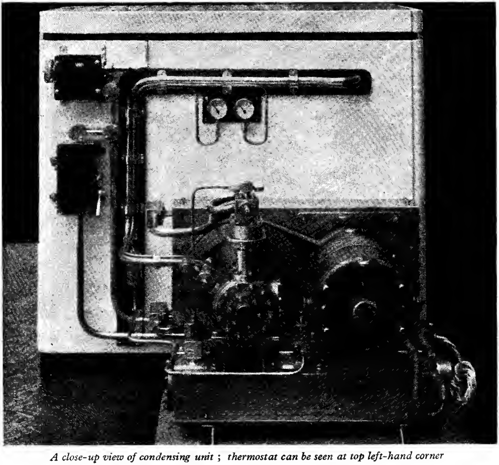
*Refrigeration in Miniature

by J. McCreesh

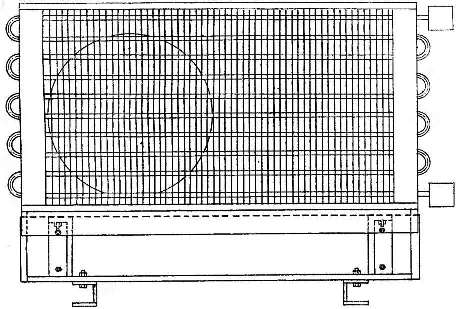
AS I have already mentioned, the crankcase is under pressure and the device used for sealing the pulley end bearing sleeve is known as a shaft seal, all types of which give trouble some time or the other and this is the most likely place to look for a leak. The one used in this case is an exact replica in miniature of a certain manufacture of compressor. It comprises a shouldered bush ; on to the shoulder is sweated a copper bellows, and to the opposite end of the bellows is sweated a steel ring or seal nose, preferably hardened, which is carefully lapped to mirror finish and must have free movement along the shouldered bush. Pressing against this is another ring fitted with six pins to take six small compression springs. These are retained by a further ring which has six holes drilled in it and allowed a sliding fit over the pins, the whole assembly being then secured to the crankshaft by a large nut and a copper gasket between the seal ring end of the assembly and the shoulder of the bearing journal. The lapped face of the seal now runs against a similar lapped face, but of phosphor bronze, on the bearing plate. I think a clearer picture of the assembly will be shown in the sketch of compressor.

The unit condenser is made, as near as possible, to represent a full-size air-cooled condenser which is usually made similar to car

**Continued from page* 66, "*M.E.*," *January* 20, 1949.

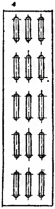


A close-up view of condensing unit ; thermostat can be seen at top left-hand corner



Rear view of condenser

radiators as regards the fins and tubing. This one is made up of channel section end frames and cooling fins. Three banks of ⅛-in. o.d. copper tubing bent into laps run through the fins and terminate into a header at top and bottom. The condenser is cowled at the front with a diaphragm at one end for motor fan.

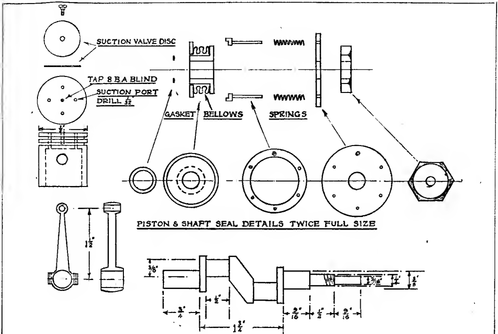


Section view of condenser end frames and vanes

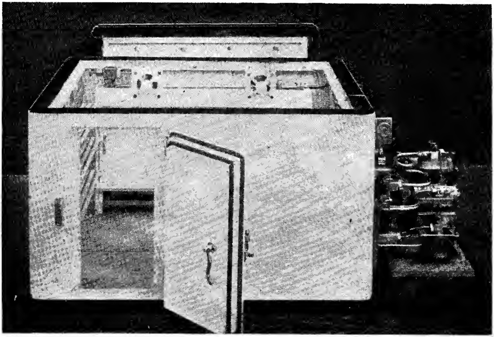
The liquid gas receiver is of the horizontal type and runs between the two frame members: it is made of 1½-in. × 1-in. bore brass tube with removable end flange plates. One plate is fitted with a glass window so as to see gas level. Working shut-off valves are fitted to inlet and outlet, the latter with a syphon tube to within $\frac{1}{16}$ in. of the bottom of the receiver. Working shut-off valves are also fitted to suction and discharge of compressor.

The motor, which was purchased, is a very powerful continuous duty motor of 1/20 h.p. approximately, running at 230 volts a.c. or d.c. The only trouble with it is that it is very much over-speed, bringing the compressor speed to about 900 r.p.m., which, owing to this abnormal speed, picks the oil up and chases it around the system. Compressor speeds are usually about 400-600 r.p.m. The motor is fitted on to correct adjustable motor slide rails, and a correct stream-lined three-bladed condenser fan is fitted to the motor pulley. Transmission from motor to compressor is supplied by a ½-in. wide endless woven cotton belt, which was kindly supplied by Messrs. J. H. Fenner Ltd., of Hull. Drives on units of this type are nowadays made up of 1, 2, 3 or more V-ropes, and I originally turned up the pulleys with three ⅛-in. wide V-grooves but found that it was impracticable for the makers to supply this width and so a flat belt had to be used, which, although it does not look the part, is very satisfactory.

The thermostat was the most difficult part to make. A length of 3/32-in. copper capillary tube was soldered on to a copper bellows, the other end of the tube being the phial or element, and the whole assembly was charged with liquid methyl chloride. The bellows is opposed by a short compression spring which in turn operates a bell crank, to which is attached the electrical contacts. When the temperature to which the



Details of compressor



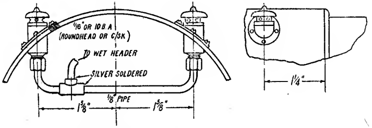
*A view with top removed, showing **dummy fans. Expansion-valves can be seen** to the left of one fan*

"MAID," "MINX" and "DORIS"

Snifting-Valves

by "L.B.S.C."

ALL three engines will require snifting-valves, or to give them their "scientific" name, vacuum relief valves. The full-sized Southern "L1" class, big sisters to the "Maid," originally had the well-known and familiar Maunsell "snails' horns" on either side of the smokebox, just behind the chimney. The present C.M.E. doesn't believe in them, and they are being removed, the holes being covered with patch plates; an anti-carbonising device is being substituted. This procedure has become a debatable point in full-sized locomotive circles; but whether the "ayes" or "noes" have it, there isn't the slightest doubt about the necessity for relieving the vacuum caused by the pumping action in the cylinders of a little engine, which takes place as soon as the regulator is shut. Unless some other means of admitting air is provided, it will go down the blastpipe, and take a certain percentage of the contents of the smokebox with it; and it doesn't need a Sherlock Holmes to deduce that the ash and grit are going to do what the kiddies call "a bit of no good" to the valves, port faces, and cylinder bores. A mixture of smokebox ash, grit, and cylinder oil forms an excellent grinding paste! This can be avoided, as has been done in full-size, by admitting air to the superheater header *via* an automatic valve—an air clack, if you like—and the "sniffing" action of this when running with steam shut off, gave it its nickname of snifting-valve. Air could, of course, be admitted direct to the steam chests (which has also been done in full-size) but this would tend to cool the cylinders, and cause the engine to throw drops of water from the chimney when opening up again. By sniffing the air through the superheater, the cylinders are not only kept warm, but overheating and burning of the superheater elements are prevented; so we kill two birds with one shot. Most followers of these notes know the above already; but, from my correspondence, I know there are a lot of new beginners on the job, so thought it desirable to explain, before going on to construction.



How to erect snifting-valves on "Maid of Kent"

Types of Valve Required

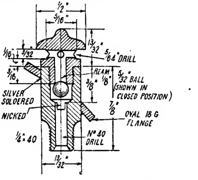
As the "Maid" is, in effect, a small edition of the "L1" class, we might as well decorate her smokebox with "snails' horns." The full-sized "Minx" engines did not have snifting-valves at all, as the slide-valves were nearly vertical, and dropped off the port faces as soon as the regulator was shut, so there was no vacuum in the cylinders at all, both ports being open. You could hear them seat again with a loud crack when opening the regulator. As the valves on the little "Minx" are on top, and cannot fall away from the port faces, a snifting-valve is needed; and we can put one upside down, inside the smokebox, close to the door, so that it takes air from outside, just ahead of the smokebox saddle. "Doris" needs one, because she has piston-valve cylinders, and, of course, they don't lift at all; and it can be fitted exactly as on the "Minx," so one description does for both engines.

How to Make the Maunsell Type

The valves shown in the illustrations are externally "to scale," both in appearance and size; I'm with old Inspector Meticulous all the way, in objecting to any outsize and ungainly excrescences on the smokebox of a neat and pleasing type of locomotive! However, the internals are considerably simplified, without sacrificing any efficiency, as the section will show. The valve is made from bronze or gunmetal rod, for preference, though brass will do if nothing better is available. Chuck a bit of $\frac{7}{16}$-in. round rod in three-jaw, and turn down about 1 in. of it to 13/32 in. diameter. Further reduce $\frac{5}{16}$ in. length to $\frac{1}{4}$ in. diameter with a round-nose tool, and screw $\frac{1}{4}$ in. by 40 for a bare $\frac{1}{4}$ in. length. Face the end, centre deeply with size "E" centre-drill, then drill down about 1 in. depth with No. 40 drill. Part off $\frac{7}{8}$ in. from the end. Reverse in chuck, open out the other end to $\frac{3}{8}$ in. depth with 7/32-in. drill, and tap $\frac{1}{4}$ in. by 40. Nick the bottom of the hole with a little chisel made from $\frac{1}{8}$-in. silver-steel, so that

air can pass the ball freely when it is resting on the bottom of the hole, its position when coasting. Slightly countersink the end of the tapped hole, and skim it up truly.

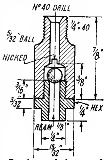
Chuck a piece of $\frac{1}{2}$-in. rod, and turn down a full $\frac{3}{16}$ in. length to $\frac{1}{4}$ in. diameter, using a knife-tool this time, to form the shoulder. Screw $\frac{1}{4}$ in. by 40. Centre, and drill down with No. 34 drill, to a depth of $\frac{7}{16}$ in. then follow up with a $\frac{1}{8}$-in. parallel reamer, putting same in as far as it will go. Take a skim off the end, to form a true seating for the ball. Part off at 13/32 in. from the shoulder; this gives "scale" height. Re-chuck in a tapped bush held in three-jaw; any odd bit of round rod over $\frac{3}{8}$ in. diameter will do for this. Just face, centre, drill 7/32 in., tap $\frac{1}{4}$ in. by 40, slightly countersink the end, and skim it off truly. Screw the top of the snifting-valve into it tightly; form the recess with a 3/32-in. parting-tool, the diameter at the bottom of the recess being $\frac{5}{16}$ in. It is hardly worth while making up a special form-tool for turning the ornamental top, just for two valves. The outline can be formed by careful manipulation of



Section of Maunsell type snifting-valve

both slide-rest handles, or by using a hand-tool, of the shape shown in the sketch. This is made from a bit of $\frac{3}{8}$-in. square tool-steel; odd lengths of high-speed stuff which have become too short to use in the slide-rest, make nobby hand-tools if brazed to a bit of mild-steel of same section from 9 in. to 12 in. long, fixed in an ordinary file-handle. No special hand-rest is needed; I just put a tool in the slide-rest tool-holder with the shank end projecting, run same up to the job, and use the shank to rest the hand-tool on, whilst in use. Hand-tools are mighty useful for certain jobs; for example, I can turn a dummy whistle, or a L.B. & S.C.R. type head or tail lamp body (loud cheer from Mr. Hambleton!) in next to no time, with a hand-tool.

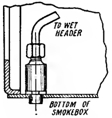
At $1\frac{1}{4}$ in. from the rear end of the smokebox, and $1\frac{5}{8}$ in. off top centre, drill a $\frac{3}{8}$-in. hole each side of the smokebox. If you have a 13/32-in. parallel reamer, put a tap-wrench on the shank, insert into the hole, and as you turn it, bring it up vertical. If you haven't a reamer, use a drill same size; hold it in a carpenter's brace for preference, and bring the drill to vertical position as you open out the hole. Carefully file off all burrs, and slightly countersink the holes with a small half-round file. Now drill two $\frac{3}{8}$-in. holes in a piece of 18-gauge sheet brass or copper, bend this to the radius of the smokebox, and give both holes a dose of the same medicine; after which, cut around the holes, so as to leave a couple of slightly oval washers a full $\frac{1}{8}$ in. wide. Screw the ornamental tops of the snifting-valves in the bodies (don't put the balls in yet) and put on the washers or flanges as shown in the illustration. Then try the snifting-valves in position, adjusting the flanges so that the valves fit exactly as shown; bodies vertical, and the cap or top almost flush with the flange on the side nearest the top of boiler. Remove valves, being careful not to upset the position of the flanges; remove the tops, and silver-solder the flanges to the valve bodies. Pickle, wash off and clean up.



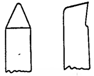
Section of inverted snifting-valve

Seat a couple of rustless steel balls, 5/32 in. diameter, on the faced ends of the caps, by the same process described for seating pump valves. Drill two cross-holes, with 5/64-in. or No. 48 drill, at right-angles across the bottom of the recess; these holes will cut into the central passage. Drop the balls into the pockets, screw home the caps with a touch of plumbers' jointing on the threads—keep it off the ball seats!—then drill four No. 51 holes around the flange, put the valves in place on the smokebox, and attach them by four $\frac{1}{16}$-in. or 10-B.A. brass screws, roundheads or countersunk, whichever you prefer. As the slots will get bunged up when the smokebox is painted, and round screwheads will then become "rivets," I can anticipate the preference of quite a lot of builders!

These little snifting-valves are well worth the trouble of making and fitting, especially by those good folk who love a touch of realism in details. Apart from their usefulness, their personal



How to erect snifting-valves on "Minx" and "Doris"



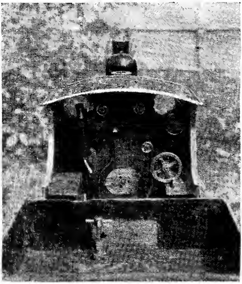
Business end of hand-turning tool

appearance, and the tiny puff of steam and the audible click, as the balls smack against the seats when the regulator is opened, reproduces one of the characteristics of a full-sized "L1."

How to Connect Up

The pipe connections are simplicity itself, and the illustration hardly needs explaining. All that is needed, is a piece of $\frac{1}{8}$-in. copper tube

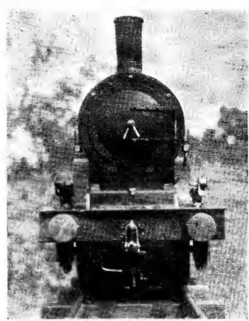
with a union cone and $\frac{1}{4}$-in. by 40 union nut on each end, long enough to connect the two unions under the snifting-valves. A tee is provided anywhere in the pipe, and the $\frac{1}{8}$-in. pipe already attached to the wet header, is silver-soldered into the stem of the tee. Regular bends and a straight pipe are shown in the drawing (easier to draw, that way !) but actually it doesn't matter how or where the pipes are run inside the smokebox, as long as they are out of the way of the other pipes. All the essentials are, that they start and finish at the right places, so that when steam is shut off, the balls drop, and admit air via the pipes to the wet header, whence it is drawn through the superheater into the cylinders and blown out through the blastpipe, thus preventing any grit or ashes going down.



Footplate of Mr. N. W. Burtt's " Petrolea," at Sharon, U.S.A.

Snifting-valve for " Minx " and " Doris "

The same size and type of snifting-valve will do for both " Minx " and " Doris," the body of the valve being made exactly the same as described above. To make the cap, chuck a bit of $\frac{3}{8}$-in. hexagon rod in three-jaw ; face, centre, and drill about $\frac{1}{8}$ in. depth with No. 34 drill. Turn down a full $\frac{3}{16}$ in. of the end to $\frac{1}{4}$ in. diameter,



" Great Eastern " all right—but a long way from Liverpool Street!

and screw $\frac{1}{4}$ in. by 40 ; skim off the end truly. Part off at $\frac{1}{4}$ in. from the shoulder ; re-chuck in a tapped bush as described above, and turn down 5/32 in. of the end to $\frac{1}{8}$ in. diameter. Run a $\frac{1}{8}$-in. parallel reamer clean through. Seat a 5/32-in. rustless steel ball on the faced end of the cap, and assemble as shown, with a smear of plumbers' jointing on the threads.

Drill a $\frac{1}{4}$-in. hole in the bottom of the smokebox, anywhere between the front ring and the saddle, and push the end of the cap through it. Fit a $\frac{1}{4}$-in. by 40 union nut and cone to the end of the $\frac{1}{8}$-in. pipe attached to the wet header, and screw this on to the union screw on the valve body, as shown in the detail illustration. The normal position of the ball in this valve is, of course, on the seating, and it is only lifted off when the regulator is shut and the cylinders are " sucking." Beginners especially note, that although I have given the pipe connection above, the actual connecting-up is not done until the smokebox is permanently attached to the boiler before erecting same on the chassis.

A 5-in. "Pittler" for a Song

(*Continued from page* 110)

The first job, therefore, consisted of cutting a new gear-wheel and putting the shaft right. Then the crank handle on the cross-slide was thrown on the scrap heap and a new hand-wheel 4 in. in diameter turned up and an adjustable micrometer collar fitted. In passing, it may be of interest to add that the cross-slide feedscrew was 10 t.p.i. *two start*, which seemed very coarse after using my 4 in. Myford.

A hand-wheel was also fitted to the top-slide, and in this state the lathe was fitted with motor and countershaft and used quite a lot, although there was still no auto-feed. But feeding by hand the lathe simply laughed at a $\frac{1}{4}$-in. cut on a piece of $4\frac{1}{2}$ in. diameter mild-steel—without back-gear in !

It can be imagined how sorry I was to have to part with the lathe, as it had great possibilities—and who knows if I shall ever get the chance again to acquire such a fine bit of machinery for a song ?